

WHAT IS CLAIMED IS:

1. A three-dimensional photographing apparatus comprising:

5 a photographing unit configured to photograph an object from a plurality of viewpoints; and

a projecting unit configured to project a pattern on the object in photographing, the projecting unit including an optical system having a projection view angle,

10 wherein the projection view angle of the optical system is set so as to project the pattern within a range where the photographing unit is able to photograph the object and on an overlapped area which is formed by overlapping photographing spaces capable  
15 of photographing the object from the viewpoints.

2. The apparatus according to claim 1, wherein the projection view angle is set so as to project the pattern on an area which is smaller than the overlapped area and which includes at least the object.

20 3. The apparatus according to claim 1, wherein the apparatus further comprises a three-dimensional reconfiguring unit configured to three-dimensionally reconfigure images of the object using an image picked up by the photographing unit, and

25 the photographing view angle falls within a range which is measured by the three-dimensional reconfiguring unit and is set so as to project the pattern in

an area which is included in the overlapped area.

4. The apparatus according to claim 1, wherein the photographing unit includes:

a camera having a photographing optical system;

5 and

a stereo adapter configured to guide images viewed from the viewpoints to the photographing optical system.

5. The apparatus according to claim 1, wherein  
10 the projecting unit includes a projection view angle adjusting unit configured to set and adjust the projection view angle in accordance with the overlapped area.

6. The apparatus according to claim 5, wherein  
15 the projection view angle adjusting unit adjusts a focal length of the optical system of the projecting unit and thus adjusts the projection view angle, and the projecting unit further includes:

a light source configured to emit light to  
20 project the pattern; and

a projecting light source adjusting unit  
configured to correct an amount of light emitted from the light source, in accordance with the projection view angle adjusted by the projection view angle  
25 adjusting unit.

7. The apparatus according to claim 5, wherein a table showing a correspondence between a view angle

of the photographing unit, relative positions of  
the viewpoints of the photographing unit, congestion  
angles of lines of sight from the viewpoints of the  
photographing unit, and the overlapped area is stored,  
5 and the projection view angle adjusting unit adjusts  
the projection view angle with reference to the stored  
table.

8. The apparatus according to claim 1, further  
comprising an illuminating unit configured to  
10 illuminate the object in photographing, the  
illuminating unit including an optical system having  
an illumination angle,

wherein the projection view angle and the  
illumination angle of the optical system are set so as  
15 to project the pattern on an area which is smaller than  
the overlapped area and which includes at least the  
object, and the area is illuminated.

9. The apparatus according to claim 8, wherein  
the illuminating unit includes illumination angle  
20 adjusting unit configured to adjust the illumination  
angle in accordance with the overlapped area.

10. The apparatus according to claim 9, wherein  
the illumination angle adjusting unit adjusts a focal  
length of the optical system of the illuminating unit  
25 and thus adjusts the illumination angle, and

the illuminating unit further includes:

a light source configured to emit light to

illuminate the object; and

an illuminating light source adjusting unit  
configured to correct an amount of light emitted from  
the light source, in accordance with the illumination  
5 angle adjusted by the illumination angle adjusting  
unit.

11. The apparatus according to claim 9, wherein  
a table showing a correspondence between a view angle  
of the photographing unit, relative positions of the  
10 viewpoints of the photographing unit, congestion angles  
of lines of sight from the viewpoints, is stored, and  
the illumination angle adjusting unit adjusts the  
illumination angle with reference to the stored table.

12. A three-dimensional photographing apparatus  
15 comprising:

a photographing unit configured to photograph  
an object from a plurality of viewpoints; and

an illuminating unit configured to illuminate  
the object in photographing, the illuminating unit  
20 including an optical system having an illumination  
angle,

wherein the illumination angle of the optical  
system is set so as to illuminate an area which is  
smaller than an overlapped area formed by overlapping  
25 photographing spaces capable of photographing the  
object from the viewpoints and which includes at least  
the object.

13. A photographing method of a three-dimensional photographing apparatus, comprising:

projecting a pattern on an object; and

5 photographing the object on which the pattern is projected, from a plurality of viewpoints,

wherein the projecting the pattern has a projection view angle which is set so as to project the pattern on an overlapped area formed by overlapping photographing spaces capable of photographing the  
10 object from the viewpoints.

14. A photographing method of a three-dimensional photographing apparatus, comprising:

illuminating an object; and

15 photographing the illuminated object from a plurality of viewpoints,

wherein the illuminating the object has an illumination angle which is set so as to illuminate an area which is smaller than an overlapped area formed by overlapping photographing spaces capable of photograph-  
20 ing the object from the viewpoints and which includes at least the object.

15. A stereo adapter comprising:

an optical path splitting optical system configured to guide images of an object viewed from  
25 first and second viewpoints that differ from each other to a photographing optical system of a photographing unit connected to the stereo adapter to acquire

a stereo image of the object; and

a projecting unit configured to project a pattern on the object in photographing,

wherein when one of two boundary lines delimiting  
5 a field of view from the first viewpoint which is  
closer to the second viewpoint is defined as a first  
boundary line, one of two boundary lines delimiting a  
field of view from the second viewpoint which is closer  
to the first viewpoint is defined as a second boundary  
10 line, and the first boundary line and the second  
boundary line intersect at an intersection point, the  
projecting unit projects the pattern on an area in  
which all points are distant from the intersection  
point with respect to the photographing optical system,  
15 the area being one of areas delimited by the first  
boundary line and the second boundary line with the  
intersection point at a top.

16. A stereo adapter comprising:

an optical path splitting optical system  
20 configured to guide images of an object viewed from  
first and second viewpoints that differ from each other  
to a photographing optical system of a photographing  
unit connected to the stereo adapter to acquire  
a stereo image of the object; and

25 an illuminating unit configured to illuminate  
the object in photographing,

wherein when one of two boundary lines delimiting

a field of view from the first viewpoint which is closer to the second viewpoint is defined as a first boundary line, one of two boundary lines delimiting a field of view from the second viewpoint which is closer  
5 to the first viewpoint is defined as a second boundary line, and the first boundary line and the second boundary line intersect at an intersection point, the illuminating unit illuminates an area in which all points are distant from the intersection point with  
10 respect to the photographing optical system, the area being one of areas delimited by the first boundary line and the second boundary line with the intersection point at a top.

17. A three-dimensional photographing apparatus  
15 comprising:

a photographing unit configured to photograph an object from a first viewpoint and a second viewpoint that is located at a given distance from the first viewpoint, the photographing unit including a  
20 photographing optical system; and

a projecting configured to project a pattern on the object in photographing,

wherein when one of two boundary lines delimiting a field of view from the first viewpoint which is  
25 closer to the second viewpoint is defined as a first boundary line, one of two boundary lines delimiting a field of view from the second viewpoint which is closer

to the first viewpoint is defined as a second boundary line, and the first boundary line and the second boundary line intersect at an intersection point, the projecting unit projects the pattern on an area in which all points are distant from the intersection point with respect to the photographing optical system, the area being one of areas delimited by the first boundary line and the second boundary line with the intersection point at a top.

10           18. A three-dimensional photographing apparatus comprising:

          a photographing unit configured to photograph an object from a first viewpoint and a second viewpoint that is located at a given distance from the first viewpoint, the photographing unit including a photographing optical system; and

          an illuminating unit configured to illuminate the object in photographing,

          wherein when one of two boundary lines delimiting a field of view from the first viewpoint which is closer to the second viewpoint is defined as a first boundary line, one of two boundary lines delimiting a field of view from the second viewpoint which is closer to the first viewpoint is defined as a second boundary line, and the first boundary line and the second boundary line intersect at an intersection point, the illuminating unit illuminates an area in which all



points are distant from the intersection point with respect to the photographing optical system, the area being one of areas delimited by the first boundary line and the second boundary line with the intersection point at a top.

19. A stereo adapter connected to a photographing unit having a photographing optical system for three-dimensional photography, comprising:

an optical path splitting optical system  
configured to guide images of an object viewed from a plurality of viewpoints to the photographing optical system of the photographing unit connected to the stereo adapter;

at least one of a projecting unit configured to project a pattern on the object in photographing and an illuminating unit configured to illuminate the object in photographing; and

an illumination angle designating value changing unit configured to receive illumination angle information for illumination, which corresponds to a photographing view angle of the photographing unit connected to the stereo adapter, from the photographing unit and conform the received illumination angle information to a characteristic of the optical path splitting optical system, thereby to control at least one of a projection view angle of the projecting unit and an illumination angle of the illuminating unit.

20. A three-dimensional photographing apparatus comprising:

photographing means for photographing an object from a plurality of viewpoints; and

5 projecting means for projecting a pattern on the object in photographing, the projecting means including an optical system having a projection view angle,

wherein the projection view angle of the optical system is set so as to project the pattern within  
10 a range where the photographing means is able to photograph the object and on an overlapped area which is formed by overlapping photographing spaces capable of photographing the object from the viewpoints.

21. A three-dimensional photographing apparatus  
15 comprising:

photographing means for photographing an object from a plurality of viewpoints; and

illuminating means for illuminating the object in photographing, the illuminating means including  
20 an optical system having an illumination angle,

wherein the illumination angle of the optical system is set so as to illuminate an area which is smaller than an overlapped area formed by overlapping photographing spaces capable of photographing the  
25 object from the viewpoints and which includes at least the object.

22. A stereo adapter comprising:

an optical path splitting optical system for  
guiding images of an object viewed from first and  
second viewpoints that differ from each other to a  
photographing optical system of photographing means  
5 connected to the stereo adapter to acquire a stereo  
image of the object; and

projecting means for projecting a pattern on the  
object in photographing,

wherein when one of two boundary lines delimiting  
10 a field of view from the first viewpoint which is  
closer to the second viewpoint is defined as a first  
boundary line, one of two boundary lines delimiting a  
field of view from the second viewpoint which is closer  
to the first viewpoint is defined as a second boundary  
15 line, and the first boundary line and the second  
boundary line intersect at an intersection point, the  
projecting means projects the pattern on an area in  
which all points are distant from the intersection  
point with respect to the photographing optical system,  
20 the area being one of areas delimited by the first  
boundary line and the second boundary line with the  
intersection point at a top.

23. A stereo adapter comprising:

an optical path splitting optical system for  
25 guiding images of an object viewed from first and  
second viewpoints that differ from each other to  
a photographing optical system of photographing means

connected to the stereo adapter to acquire a stereo image of the object; and

illuminating means for illuminating the object in photographing,

5            wherein when one of two boundary lines delimiting a field of view from the first viewpoint which is closer to the second viewpoint is defined as a first boundary line, one of two boundary lines delimiting a field of view from the second viewpoint which is closer  
10          to the first viewpoint is defined as a second boundary line, and the first boundary line and the second boundary line intersect at an intersection point, the illuminating means illuminates an area in which all points are distant from the intersection point with  
15          respect to the photographing optical system, the area being one of areas delimited by the first boundary line and the second boundary line with the intersection point at a top.

24. A three-dimensional photographing apparatus  
20          comprising:

            photographing means for photographing an object from a first viewpoint and a second viewpoint that is located at a given distance from the first viewpoint, the photographing means including a photographing  
25          optical system; and

            projecting means for projecting a pattern on the object in photographing,

wherein when one of two boundary lines delimiting  
a field of view from the first viewpoint which is  
closer to the second viewpoint is defined as a first  
boundary line, one of two boundary lines delimiting a  
5 field of view from the second viewpoint which is closer  
to the first viewpoint is defined as a second boundary  
line, and the first boundary line and the second  
boundary line intersect at an intersection point, the  
projecting means projects the pattern on an area in  
10 which all points are distant from the intersection  
point with respect to the photographing optical system,  
the area being one of areas delimited by the first  
boundary line and the second boundary line with the  
intersection point at a top.

15 25. A three-dimensional photographing apparatus  
comprising:

photographing means for photographing an object  
from a first viewpoint and a second viewpoint that is  
located at a given distance from the first viewpoint,  
20 the photographing means including a photographing  
optical system; and

illuminating means for illuminating the object in  
photographing,

wherein when one of two boundary lines delimiting  
25 a field of view from the first viewpoint which is  
closer to the second viewpoint is defined as a first  
boundary line, one of two boundary lines delimiting a

field of view from the second viewpoint which is closer to the first viewpoint is defined as a second boundary line, and the first boundary line and the second boundary line intersect at an intersection point, the  
5 illuminating means illuminates an area in which all points are distant from the intersection point with respect to the photographing optical system, the area being one of areas delimited by the first boundary line and the second boundary line with the intersection  
10 point at a top.

26. A stereo adapter connected to a photographing unit having a photographing optical system for three-dimensional photography, comprising:

an optical path splitting optical system for  
15 guiding images of an object viewed from a plurality of viewpoints to the photographing optical system of the photographing unit connected to the stereo adapter;

at least one of projecting means for projecting a pattern on the object in photographing and illuminating  
20 means for illuminating the object in photographing; and

illumination angle designating value changing means for receiving illumination angle information for illumination, which corresponds to a photographing view angle of the photographing unit connected to  
25 the stereo adapter, from the photographing unit and conforming the received illumination angle information to a characteristic of the optical path splitting

optical system, thereby to control at least one of  
a projection view angle of the projecting means and  
an illumination angle of the illuminating means.